GUJARAT TECHNOLOGICAL UNIVERSITY, AHMEDABAD, GUJARAT

COURSE CURRICULUM
COURSE TITLE: INSTRUMENTATION SIMULATION PRACTICES
(Code: 3341705)

Diploma Programmes in which this course is offered	Semester in which offered
Instrumentation and Control Engineering	4th semester

1.   RATIONALE

In the present industrial scenario, diploma engineering students should be able to understand, simulate, analyze and troubleshoot the prevalent Process Control Systems in the industry. They are required to foresee the effects of changes in the various process parameters on the system behavior before actual implementation of the Plant Control System. Therefore, this course has been designed so that students can familiarize with various simulation software tools to build and simulate the different types of Control Systems for Process Application.

2.   COMPETENCY

The course content should be taught and implemented with the aim to develop different types of skills so that students are able to acquire following competency:

- Simulate **different types of Instrumentation Control Systems for Process Application.**

3.   COURSE OUTCOMES

The theory should be taught and practical should be carried out in such a manner that students are able to acquire different learning out comes in cognitive, psychomotor and affective domain to demonstrate following course outcomes.

i.   Use instrumentation simulation software for Interactive Process Control
   Simulation.
ii.   Do System Analysis to understand the system behaviour.
iii.   Generate plots for outputs of different process automation control loop system for step and ramp input.
iv.   Simulate different control action on given control system.
v.   Install process and control instrumentation Simulating and Analyzing software.

4. TEACHING AND EXAMINATION SCHEME

Teaching Scheme (In Hours)			Total Credits (L+T+P)	Examination Scheme				Total Marks
				Theory Marks		Practical Marks		
L	T	P	C	ESE	PA	ESE	PA	
0	0	4	4	0	0	40	60	100

Legends: L-Lecture; **T** – Tutorial/Teacher Guided Theory Practice; **P** - Practical; **C** – Credit **ESE** - End Semester Examination; **PA** - Progressive Assessment.

5.   COURSE DETAILS

   NA

6.   SUGGESTED SPECIFICATION TABLE WITH HOURS & MARKS
   NA

7.   SUGGESTED LIST OF EXERCISES/PRACTICALS.

The practical/exercises should be properly designed and implemented with an attempt to develop different types of skills (**outcomes in psychomotor and affective domain**) so that students are able to acquire the competencies/programme outcomes. Following is the list of practical exercises for guidance.

*Note: Here only outcomes in psychomotor domain are listed as practical/exercises. However, if these practical/exercises are completed appropriately, they would also lead to development of certain outcomes in affective domain which would in turn lead to development of **Course Outcomes** related to affective domain. Thus over all development of **Programme Outcomes** (as given in a common list at the beginning of curriculum document for this programme) would be assured.*

Faculty should refer to that common list and should ensure that students also acquire outcomes in affective domain which are required for overall achievement of Programme Outcomes/Course Outcomes.

S. No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx Hrs. required
1.	Install process and control instrumentation Simulating and Analyzing softwares and familiarize with the system requirements and essential features/specifications of the software in use.	02
2.	Simulate basic instruments viz indicators for a simple process loop.	02
3.	Simulate basic instruments viz recorders for a simple process loop.	02
4.	Simulate basic instruments viz indicator, recorder and controller for a simple process loop.	02
5.	Determine poles and zeros of given first order transfer function.	02
6.	Obtain poles and zeros of given second order transfer function.	02
7.	Develop mathematical model for a single process parameter of a tank system.	02
8.	Simulate P -control action on a given system for given step/ramp input and set point. Obtain the effect on output varying Kp of the system.	02
9.	Simulate I -control action on a given system for given step/ramp input and set point. Obtain the effect on output varying Ki of the system.	02

S. No.	Practical Exercises (Outcomes' in Psychomotor Domain)	Approx Hrs. required
10.	Simulate P+I -control action on a given system for given step/ramp input and set point. Obtain the effect on output varying K_p and K_i of the system.	02
11.	Simulate P+D - control action on a given system for given step/ramp input and set point. Obtain the effect on output varying K_p and K_d of the system.	02
12.	Simulate P+I+D -control action on a given system for given step/ramp input and set point. Obtain the effect on output varying K_p, K_d, and K_i of the system.	02
13.	Simulate a simple feedback loop for process parameter and obtain output varying set points.	02
14.	Simulate simple feed forward loops for process parameter to obtain output varying set points.	02
15.	Simulate simple cascade loops for process parameter to obtain output varying set points.	02
16.	Simulate simple ratio loops for process parameter to obtain output varying set points.	02
17.	Simulate simple split range loops for process parameter to obtain output varying set points.	02
18.	Simulate a simple instrumentation process loops to obtain output varying generating disturbance.	02
19.	Simulate simple instrumentation continuous process loops to obtain output generating disturbance in a previous sub process.	02
20.	Simulate simple bio-medical signal measuring loops to obtain output in the form of indicator and recorder.	02
21.	Simulate flow control loop using process control simulator.	02
22.	Simulate pressure control loop using process control simulator.	02
23.	Simulate On-Off level control system using process control simulator.	02
24.	Simulate interacting level system using process control simulator.	02
25.	Simulate non-interacting level system using process control simulator.	02
26.	Simulate On-Off temperature control system using process control simulator.	02
27.	Simulate various characteristic of control valve.	02
28.	Simulate control valve using different characteristic co-efficient.	02
29.	Simulate control valve to find rangeability.	02
Total Hours		58

8.   SUGGESTED LIST OF STUDENT ACTIVITIES

Following is the list of proposed student activities like:

i.   Study of First and Second Order Control System using various free control simulators.

ii. D e v e l o p simple simulated instrumentation control process system for different control actions strategies.

iii. Prepare Presentation on given topics.

9.   SPECIAL INSTRUCTIONAL STRATEGIES

i.   Use Free Simulators Software for teaching / learning activities.

ii. Show Video/Animation Films relevant to Process Automation and Control   System.

10.   SUGGESTED LEARNING RESOURCES

A)   List of Books

S. No.	Title of Book	Author	Publication
1	A Guide to MATLAB: For Beginners and Experienced Users	Ronald L. Lipsman, Jonathan Rosenberg	Cambridge University Press
2	Getting Started With Matlab 7: A Quick Introduction For Scientists And Engineers	Rudra Pratap	Oxford University press, New Delhi
3	LabVIEW 7 Express Student Edition	Robert Bishop	PHI Learning, New Delhi
4	LabVIEW™ Basics II Course Manual PDF	Worldwide TechnIcal Support and Product Information ni.com	National Instruments Corporate Headquarters 11500 North Mopac Expressway Austin, Texas 78759-3504 USA Tel

B)   List of suggested Software/Learning Websites:

i.   MATLAB,
ii.   SCILAB
iii. Prosim
iv.   PSpice
v.   LabVIEW
vi.   Chemical Process simulator
vii. Electronics Workbench
viii. www.mathworks.in
ix.   www.ni.com
x.   www.edx.org
xi.   www.coursera.org
xii. www.ocwconsortium.org

11.   COURSE CURRICULUM DEVELOPMENT COMMITTEE
Faculty Members from Polytechnics

- **Prof. M. N. Mulchandani** Sr**.** Lecturer in IC, AVPTI, Rajkot.
- **Prof. H. P. Patel**, Lecturer in IC, GP Ahmedabad.
- **Prof. N. B. Mehta,** Sr. Lecturer in IC, GP Ahmedabad.
- **Prof. S. K RAVAL**, Lecturer in IC, GP Ahmedabad.

Coordinator and Faculty Members from NITTTR Bhopal

- **Prof. (Mrs.) Susan S. Mathew,** Associate Professor**,** Department of Electrical and Electronics Engineering.
- **Prof. Joshua Earnest,** Professor, Department of Electrical and Electronics Engineering.